

CLAIMS

1. Method for modifying the length distribution for the chains of a starch, or for the chains of a glycogen, in which the activity of an  $\alpha$ -1,4 glucanotransferase enzyme is increased or decreased in the cells of a plant such that said plant produces a modified starch which differs from the starch produced naturally by the plants, by the length distribution for its external chains, or produces a modified glycogen which differs from the glycogen produced naturally, by the length distribution for its external chains.

2. Method according to claim 1, in which the level of expression of endogenous  $\alpha$ -1,4 glucanotransferase enzyme is decreased so as to cause the production of starch comprising an amylopectin which is enriched in chains containing less than 6 glucose residues.

3. Method according to claim 2, comprising the steps consisting in:

a) constructing an expression vector comprising an antisense nucleotide sequence of the gene encoding said  $\alpha$ -1,4 glucanotransferase enzyme;

b) transforming a plant cell with said expression vector;

c) regenerating the plant from the cell transformed in step b, said transgenic plant thus obtained producing a starch comprising an amylopectin which is enriched in chains containing less than 6 glucose residues.

4. Method according to any one of the preceding claims, in which said  $\alpha$ -1,4 glucanotransferase enzyme is a D enzyme.

5. Method according to any one of the preceding claims, in which said  $\alpha$ -1,4 glucanotransferase enzyme is a protein comprising an amino acid sequence encoded by the nucleotide sequence chosen from the sequence SEQ ID No. 1, or a sequence homologous to this sequence.

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6. Plant, or part of a plant, such as in particular potato, wheat, maize or rice, which produces modified starch which differs from the starch produced naturally by the plants, by the length distribution for its external chains, or which produces modified glycogen which differs from the glycogen produced naturally, by the length distribution for its external chains, said plant or part of a plant being obtained by the method according to ~~any one of the preceding claims~~.

7. Method for obtaining modified starch which differs from the starch produced naturally by the plants, by the length distribution for its external chains, in which:

- the modified starch is extracted from the plants, or parts of plants, according to claim 6;

- or a starch, extracted from plants, or parts of plants, and then solubilized, beforehand, is brought into contact with an  $\alpha$ -1,4 glucanotransferase enzyme, in the presence of optionally modified polysaccharides or oligosaccharides.

8. Modified starch obtained according to the method of claim 7.

9. Use of modified starch according to claim 8, for preparing derived products, in particular food products.

10. Products containing a modified starch according to claim 9.

11. Method for obtaining modified glycogen which differs from the glycogen produced naturally, by the length distribution for its external chains, in which:

- the modified glycogen is extracted from the plants, or parts of plants, obtained according to the method of the invention as described above.

- or a glycogen is brought into contact with an  $\alpha$ -1,4 glucanotransferase enzyme, in the presence of optionally modified polysaccharides or oligosaccharides.

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12. D enzyme of *Chlamydomonas reinhardtii* purified by the method comprising the steps consisting in:

- centrifuging the *Chlamydomonas reinhardtii* strain;
- precipitating the acellular fraction with protamine sulphate;
- passing the supernatant obtained in the previous step through anion exchange chromatography;
- subjecting the fraction not retained in the previous step to differential precipitation with ammonium sulphate;
- subjecting the supernatant obtained in the previous step to molecular sieve chromatography;
- concentrating the pellet obtained in the previous step, by cation exchange chromatography.

13. Nucleic acid comprising a nucleotide sequence chosen from the sequence SEQ ID No. 1 and a fragment of this sequence encoding a protein having  $\alpha$ -1,4 glucanotransferase enzymatic activity.

14. Nucleic acid comprising a sequence which is complementary to the sequence as defined in claim 13.

15. Cloning and/or expression vector comprising a nucleotide sequence as defined in claim 13 ~~or 14~~.

16. Protein having  $\alpha$ -1,4 glucanotransferase enzymatic activity, comprising an amino acid sequence encoded by a nucleotide sequence as defined in claim 13.

17. Use of a nucleic acid comprising a sequence encoding an  $\alpha$ -1,4 glucanotransferase enzyme or a sequence which is the antisense sequence to said sequence encoding an  $\alpha$ -1,4 glucanotransferase enzyme, for modifying the length distribution for the external chains of starch or of glycogen.

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